GUIDELINES FOR THE IDENTIFICATION OF ALLUVIAL VALLEY FLOORS

Prepared By

the Montana Department of State Lands

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Introduction

This document is a set of alluvial valley floor (AVF) guidelines compiled by the Department of State Lands (DSL). These guidelines are not statutory, but are to be considered "rules of thumb". The intent of the guidelines is to outline the information necessary for DSL to make an AVF determination, and to allow an applicant to better plan the submittal of a coal mine permit application. Prior to any AVF investigations, the applicant should contact DSL to discuss the plan and extent of study required. The site specific nature of AVF determinations may dictate that more or less data be collected than is suggested in these guidelines.

The applicant should consult Montana's Strip and Underground Mine Reclamation Rules and Regulations to understand the basis of the recommendations of this Guideline. Once an AVF determination has been made by DSL an applicant is referred to Sub-Chapter 8 of the Rules and Regulations which pertains to mining through or near an AVF.

The first section of this document is a set of definitions that pertain to the AVF decision-making process. The last two sections are devoted to fulfilling the requirements of Rule 26.4.325(2)(b) which states, "..... The Department shall determine that an alluvial valley floor exists if it finds that:

(i) unconsolidated stream-laid deposits holding streams are present; and
(ii) there is sufficient water to support agricultural activities".

I. Definitions

"Alluvial Valley Floor" means the unconsolidated streamlaid deposits holding streams where water availability is sufficient for subirrigated or flood irrigated agricultural activities; but the term does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits by unconcentrated runoff or slope wash, together with talus, other mass movement accumulation, and windblown deposits.

"Aquifer" means any geologic formation or natural zone beneath the earth's surface that contains or stores water and transmits it from one point to another in quantities which permit or have the potential to permit economic development as a water source.

"Capillary Fringe" means moist soil in direct communication with the water table by capillary action. The thickness of the capillary fringe may be generally assumed to be three feet above the water table when field testing is not practical.

"Diversion" means a channel, embankment, or other manmade structure constructed to divert water from one area to another.

"Farm" means one or more land units on which agricultural activities are conducted. A farm is generally considered to be the combination of land units with acreage and boundaries in existence prior to August 3, 1977, or if established after August 3, 1977, with those boundaries based on enhancement of the farm's agricultural productivity and not related to strip or underground coal mining operations. Farm and ranch are synonymous terms with respect to AVF determinations.

"Flood Irrigation" means, with respect to alluvial valley floors, supplying water to plants by natural overflow or the diversion of flows, so that the irrigated surface is largely covered by a sheet of water.

"Regional Terrace Levels" means, with respect to Montana AVF determinations, those corresponding terrace levels within a five (5) mile radius of the potential AVF being studied.

"Subirrigation" means, with respect to alluvial valley floors, the supplying of water to plants from underneath or from a semisaturated or saturated subsurface zone where water is available for use by vegetation.

"Surficial Geologic Map" means, as it pertains to this document, a map delineating the aerial extent of bedrock units and residual, alluvial and colluvial deposits exposed at the ground surface.

"Unconsolidated Streamlaid Deposits Holding Streams" means, with respect to alluvial valley floors, all flood plains and terraces located in the lower portions of topographic valleys which contain perennial, intermittent, or ephemeral streams.

II. Unconsolidated Streamlaid Deposits

The first criterion considered in an alluvial valley floor determination is the presence of unconsolidated streamlaid deposits holding a stream. The following is a list of information the Department considers useful in making this determination:

1. A map of the stream including delineation of the surface watershed;

2. A map delineating local and regional terrace levels and the topography of terraces, flood plains and channels showing surface drainage patterns;

3. A surficial geologic map of unconsolidated deposits, to include distinctions between bedrock controlled areas and colluvium, and streamlaid deposits.

4. Drill hole data: DSL should be contacted in the initial stages of an AVF investigation for recommendations on the number of drill holes, monitoring wells and geologic cross sections necessary to define the geology and hydrology of the study area. The number of holes, wells and cross sections necessary is site specific and can only be determined upon examination of the potential AVF.

5. An alluvial isopach map, geologic cross sections of the alluvial channels and valley surface cross sections.

III. Water Sufficient to Support Agricultural Activities

The second criterion considered in an alluvial valley floor determination is the presence of sufficient water to support agricultural activities as evidenced by:

A. the existence of flood irrigation in the area in question and its historical use;

B. the natural capability of an area to be flood irrigated; or

C. subirrigation of the lands in question, derived from the groundwater system of the valley floor.

The following is a list of information the Department considers useful in evaluating water sufficient to support agricultural activities:

1. Annual precipitation data.

2. A land use map delineating management units (including grain, hay and pasture types) and location of existing irrigation structures.

   This map(s) should include total farm boundaries for any farm with acreage within the AVF study area.

3. Management practices onsite and regional.

   a) Historic practices including establishment and effectiveness of irrigation systems.

   b) Landowner interviews to establish management rationale.

   c) Type of crops produced by dominant species.

      i) Production figures from clipped plots and/or landowner estimates to include the number of units (i.e., bales, stacks) taken from a field and the representative weights/unit.

      ii) Age of present crop stands and common rotation used (if any).

      iii) Type of irrigation used (sprinkler, diversion, etc.) including:

         1.) Description of average water budget for irrigation to include average monthly stream flow, yearly and seasonal variations including low flow years, and the acreage of prior water rights areas which have priority use of available water.

         2.) Source of water used for irrigation.

   d) Type of livestock operation:

      i) Livestock variety and numbers.

      ii) Amount of hay feed per winter and/or sale of hay for profit.

      iii) Description of the grazing management to include an AUM breakdown by season.

4. Soil analysis:

   a) An accurate description of the lithology of the entire thickness of the alluvial deposit.

b) The extent and intensity of further textural and chemical analyses will be determined by DSL and company personnel upon evaluation of the lithologic data. The methods of analysis should be consistent with the Soils and Overburden Guidelines. More detailed analysis will include:

i) Textural analyses of the alluvial deposit (actual depths to be determined on a site specific basis).

ii) Chemical analyses to include EC, SAR and pH.

iii) A soil survey including a determination of the capability of the soils under irrigation as defined by the Soil Conservation Service capability groupings.

5. Hydrogeologic Data

a) Installation of observation wells for determination of depth to groundwater, texture and lithology of unconsolidated deposits, thickness of capillary fringe, aquifer characteristics, and water quality. Monitoring should be performed at frequencies sufficient to indicate long term trends (a minimum of two (2) years).

i) The applicant may use backhoe pits and soil moisture tubes to determine rooting depths and soil moisture characteristics.

b) Well and spring inventory.

c) Surface water quality analyses describing seasonal variations over one full year at a minimum.

d) Saturated thickness and volume of aquifers associated with streams, including alluvial aquifers, perched aquifers and other water-yielding zones found beneath valley floors. These studies should be conducted to the depth of the next significant aquifer below the coal to be mined.

6. Color infrared photographic data:

a) Color infrared aerial photographs or color infrared 35 mm slides taken in the latter part of the growing season (August or September) to show the difference between vegetation benefitting from subirrigation and vegetation undergoing water stress. In some cases photos taken in July may be necessary to determine extent of subirrigation.

b) The photographs or slides should be at a scale adequate for identification of potential AVF areas. The Department recommends a scale of 1:12,000.

June 11, 1980

AVF Preamble
Alluvial Valley Floor Guidelines

These documents represent the most recent drafts prepared by the Region V Office of Surface Mining. They reflect the regional staff's analysis of public comments on the proposed guidelines published in the Federal Register on August 25, 1979. These documents represent OSM's current method of analysis of alluvial valley floors, and may be changed to reflect changing conditions. These documents are guidelines only and the contents are not to be interpreted as mandatory. The documents are made available to the numerous individuals who expressed a need for such guidance and discussion. Departures from suggested methods should be cleared with the regulatory authority to avoid misunderstandings.

Attachments (2)

AVF
PREAMBLE

On August 25, 1978, the Office of Surface Mining published draft Technical Guidelines, Identification and Study of Alluvial Valley Floors. A public hearing was held regarding these guidelines on October 13, 1978, in Denver. A public comment period lasted until November 1, 1978. A total of 14 oral comments were received at the public hearing and about 25 written comments were received within the comment period. Comments were received from various western state governments, coal industry, industry consultants, and agricultural and conservation organizations. This revision is a direct response to those comments.

Guideline Organization

Several commentators maintained that the Guidelines were too complex. These commentators urged that the Guidelines be simplified and that a reconnaissance procedure for identifying areas clearly not alluvial valley floors be established. The Department agrees that the procedures to eliminate certain stream and floodplain areas from further consideration as alluvial valley floors were clearly established in the proposed Guidelines. In response to these comments, the Guidelines have been reorganized in three parts. Part I Title addresses the reconnaissance or preliminary investigations which could be used to distinguish between lands which may be alluvial valley floors and lands clearly not alluvial valley floors. Part II addresses intermediate investigations which can provide sufficient information to permit a final determination of alluvial valley floor status, and Part III, presents studies which could be used in submittal of a complete permit application. These Part III studies can lead to definition of the important characteristics of AVFs, the agricultural significance of AVF's and the impact of mining on AVF's.

The procedures outlined in Part I of these Guidelines are intended to be those which can be accomplished in a short period of time. The information collected at this time would include surficial geologic mapping of stream channel and floodplain (valley bottom) areas, land use mapping and analysis of regional irrigation activities, and reconnaissance botanical investigations, principally conducted on the site. Part I of the Guidelines describes how land use data may be used to investige the potential for flood irrigation on lands within the region. Lands within a region surrounding and characteristic of the mine plan and adjacent areas may, under the procedure, be evaluated to determine the presence of historic and current flood irrigation. This information may be used, in addition to observations of flood and subirrigation within the mine plan and adjacent areas, to determine the potential for flood irrigation in the permit area and in areas which may be affected by the proposed surface coal mining operation. Lands within the mine plan and adjacent areas with characteristics similar to those flood irrigated lands identified within the region are then to be classified as potentially flood irrigable, at this reconnaissance level.

Part II of the Guidelines outlines procedures which are generally more expansive and time consuming, but which are also representative of the procedures necessary to clarify the status of areas identified as possible alluvial valley floors (i.e., areas which may be alluvial valley floors). Part III outlines the extent of studies that could be used to define the essential hydrologic functions of alluvial valley floors. These procedures are all field-oriented and the extent of the studies depends on the complexity of the alluvial valley floor (principally hydrologic complexity).

These final Guidelines have been reorganized to include all the reconnaissance level studies from the proposed Guidelines (August 25, 1979) in the revised Part I. Part II contains more detailed identification procedures. Part III retains the same material, with internal revisions, as was in the proposed Guidelines.

A few commentators desired inclusion of faster procedures for alluvial valley floor assessments. We believe that professional use of the Guidelines will support and facilitate expeditious identification of alluvial valley floors. We recognize expeditious identification is tied with the desire for clear identification of criteria for negative determinations. The first phase of the review can be performed in a short time. The second and third phases of the Guidelines can be performed in a relatively short time. The second and third phases of the Guidelines are closely tied with the environmental information gathering needed for a mining and reclamation plan for any location, regardless of whether an alluvial valley floor is involved. If questions remain regarding negative determinations, the applicant can request evaluations of potential alluvial valley floors prior to submission of the entire plan, provided, of course, that adequate data are supplied with the request. The regulatory authority's assessment is simplified if the alluvial valley floor analysis is accompanied by a regional analysis of the environment that accompanies a mine plan. If the request for an early evaluation of an alluvial valley floor is submitted, it must be complete. The time required for the third phase is obviously directly proportional to the complexity of the hydrologic system.

Study in Areas Surrounding Permit Area

A significant number of, industry and consultant, commentors argued that the guidance under Part I of the draft regarding "a reconnaissance examination of all lands within 2 miles of the proposed permit area" was too broad, required study on lands not controlled by the permittee, and was not substantiated by technical studies. A conservation group maintained that the study of areas within two miles of a permit area should be a minimum study area. The Department recognizes the limited number of geohydrologic studies available which can be used to generalize the extent of surrounding area studies. In light of this situation, and in light of industry's contention that insufficient flexibility exists in a guidance for study two miles radius about a permit area, the Department accepts the suggestion that the study area be

defined at the operator's discretion, provided the studies include the entire "adjacent area," as defined in 30 CFR 701.5. This revision thus permits the operator's discretion in determining a study area. In one sense, this revision eliminates the need to study areas not potentially affected by mining. In another sense, it places great responsibility on the operator to sufficiently anticipate the limits of an adjacent area since in no case can a permit application be acted on if environmental data is not submitted for all parts of the adjacent area. Industry comments received on the draft make it clear that industry desires this greater level of responsibility.

One industry commentor stated that detailed studies are unnecessary for determinations of the extent of the adjacent area. The Department recognizes that this may be the case if detailed studies have already been conducted in a nearby area. Generally, however, the Department feels that adjacency determinations should be based on the detailed environmental studies already required regulation.

One commentor requested that the guidance consider the situation where mining did not occur in an alluvial valley floor but rather in its headwaters. Under the revised Guidelines, mining in headwaters areas would evaluate downstream alluvial valley floors if they were found to lie in the adjacent area, that is, the area which "may adversely be affected" by mining. Thus, the situation described by the commentator would be evaluated.

One commentator hypothesized that alluvial valley floors were only surface water features and thus field investigations need not extend past the topographically defined surface water drainage basin. OSM can identify situations where alluvial valley floors only possess flood irrigation characteristics related to surface water factors. However, a potential to find subirrigation exists and must be evaluated whenever mining may effect ground water regardless of drainage basin location.

If investigations show that an alluvial valley floor's water availability is related only to surface water and is not related to ground-water, detailed study can then be limited to a surface watershed.

Study Area in Relation to Permit Area
and Mine Plan Area

One commentator expressed uncertainity as to whether alluvial valley floor studies are suggested to be conducted in the mine plan area or in the permit area. The Department feels that alluvial valley floor studies must, at a minimum, evaluate the existence of alluvial valley floors in the permit area and adjacent area, and permit applications must address this geographic study area. At this time, the Department suggests, but does not require, the study and determination of alluvial valley floor status in the mine plan area and its adjacent area. The Department feels that it is useful to both industry and regulatory agencies to identify alluvial valley floors in the entire mine plan area at the time of submittal of the first permit application, however, at this time, this type of broad geographic study remains a suggestion and not a requirement.

Mapping Scales

One commentator suggested that mapping of potential alluvial valley floor areas in Part I need only be completed at the scale of 1:24000 and not the larger scale of 1:6000 suggested in the draft Guidelines. In reorganizing these guidelines to isolate reconnaissance procedures in Part I, the Department recognized the utility in using smaller scale maps during initial investigations. Reconnaissance data often cannot be accurately plotted at the larger 1:6000 scale, and is a more time consuming process. Also, the Department recognizes that mapping of 1:24000 scale is adequate for purposes of the initial procedure. Thus, the suggestion of map scales in Part I was changed.

Relationship to Other Programs

Two commentators recommended the Guidelines mesh with the Federal Land Management Policy Act (FLMPA) and Reactive order 11990 regarding wetlands protection. In the first situation, the FLMPA requires land use planning for federal lands. It is possible, if not certain, that the federal land planning system has and will produce information of value to alluvial valley floor studies. Therefore, the information should be used. Similarly, the Geological Surveys of both the Federal Government and the State Governments produce information of value to alluvial valley floor studies. The Guidelines make clear that all sources of available data should be used. Conversely, the guidelines may be of use to land planning entities.

The protection of wetlands for wildlife habitats is likely to be a concern in some alluvial valley floor areas. However, the SMCRA addresses protection of wildlife in sections other than those designed to protect alluvial valley floors. The information that is derived from mine planning involving alluvial valley floors will also identify the important characteristics of any wetlands in the area. The two concerns will be meshed in permit and procedures implemented under SMCRA.

Access

One commentator raised questions concerning the issue of access to private lands in an adjacent area not controlled by the operator. It was asked - what if access is denied? The Department recognizes that this situation may occur. It is hoped that cooperation between the operation and land owners can eliminate access problems. In the event access is initially denied, the appropriate regulatory authority may be able to assist the operator in gaining access to private lands.

Qualifications of Personnel Conducting Alluvial Valley Floor Studies

One commentator suggested that the qualifications of personnel involved in alluvial valley floor studies should be outlined. During the development of the guidelines, discussion did develop concerning the types of individuals who should be involved in these studies. The Department suggests that an interdisciplinary effort is needed to evaluate alluvial valley floors. A range scientist or botanist and a geologist or geomorphologist can together develop the data suggested in Part I. Parts II and III require additional input from a geohydrologist and soil scientist. Part III studies broaden to also include the effects of an agricultural economist.

Interpretation of Section 510b5B, PL 95-87

One commentator strongly argued that the discussion of the application of Section 510b5B in the Guidelines was issued in err. Another commentator agreed with the discussion. The dialogue on this issue has continued since promulgation of the Guidelines, particularly during the comment period to the permanent regulatory program. The Department had dropped discussion of the statutory interpretation in the Guidelines since the issue is more appropriately discussed elsewhere. For information purposes, however, it is the Department's present position that Section 510b5B refers to alluvial valley floors prohibited from mining under Section 510b5A. The provisions of Section 515b10F, however, apply to all alluvial valley floors, regardless of agricultural significance.

Other Guidances

One commentator suggested that guidance be provided concerning studies and determinations required under Sections 507(b)(11), (determination of the probable hydrologic consequences of mining and reclamation), 510(b)(3), (assessment of probable cumulative impact of mining), 515(b)(10)(D), (restoration of recharge capacity), and 515(b)(10)(F), (preservation of the essential hydrologic functions of alluvial floors).

The Department recognizes the need for guidance in these, or other, areas, however, the subjects, except for §515(b)(10)(F) are generally outside the province of this particular guidance document. Part III of this guidance has been developed to suggest studies which would meet the concerns of Section 515(b)(10)(F). The Department will endeavor to develop guidance on other subjects at later times.

Applicability to Underground Mining

In accordance with the requirements of the permanent regulatory program, the Guidelines clearly apply to operations conducted in, adjacent to, or under alluvial valley floors (see Section 785.19(a) of the regulations).

Thus, underground coal mining operations must also assess the potential effects of underground and surface operations on alluvial valley floors. This requirement would undoubtedly include the analysis of the potential effects of subsidence on renewable resource lands.

Use of Soil Survey

One commentator recommended that a soils survey be included in the initial identification phase of the Guidelines. Another commentator indicated that such a survey should be equivalent to the U.S. Soil Conservation Service county surveys. On the one hand, a soil survey can certainly be useful during the initial investigation phase. However, soil surveys without site-specific geologic, vegetation and water quality information is not particularly useful. Since soils mapped at a county under scale may not be an accurate delineator of terraces or flood plains. Generally, other observations should be made along with the onsite sampling of soils. Countywide soil surveys are not designed for the types of analyses required in initially designating alluvial valley floors. A county-scale soil survey report is usually prefaced by a cautionary statement to the effect that the survey should be used for only general planning purposes. Essentially, the soil survey required for an alluvial valley floor, if there is a question of irrigation suitability or if the alluvial valley floor is to be mined and reclaimed, is the same soil survey often of an order II, required to satisfy other requirements of the Act and regulations for protection of the soil resource.

Aerial Imagery

One commentator wanted to decrease the significance of the Guidelines' reference to using aerial imagery and other reconnaissance investigation tools in Part I of the identification process. The revision now notes that all available data, including aerial images to be used. In view of the increasing use of color-infrared aerial imagery for assessing irrigation (and sub-irrigation), however, it seems appropriate to continue to point out the usefulness of aerial imagery. The Department also has a substantial volume of imagery that can be reproduced and used by operators to evaluate water availability near many of the operating mines in the western United States.

Geomorphic Characteristics

One commentator suggested that at the initial phase of alluvial valley floor determinations, all terraces, regardless of physiographic or topographic location, be considered to meet the geomorphic characteristics of alluvial valley floor's. The Department finds, however, that the geomorphic characteristics which define an alluvial valley floor includes the topographic modifier "valley floor". Although high, isolated terraces unconsolidated streamlaid deposits, often this location cannot be construed to be in a valley floor. The Department cannot justify examination of terraces not found in valley floors.

Alluvium/Colluvium distinction

The draft guidelines stated, "This guideline does not necessitate that a distinction between colluvium and alluvium if valley fills be made." (U.S. Office of Surface Mining, 1978, p.38040). Three industry commentators objected strongly to this statement, arguing that the statutory definition inherently requires that such a distinction be made. It is the Department's interpretation of the definition, however, that the distinction is not critical in valley fill deposits. PL95-87, § 701(1) uses colluvium to modify only the term "upland area" and not to modify the term "valley floor." The statutory definition establishes that unconsolidated deposits of valley floors, principally of alluvial origin, are the fundamental geomorphic characteristics of alluvial valley floors.

Floodplains

Several commentators criticized the discussion of active floodplains in the draft guidelines. This discussion of valley floor areas has been dropped, and reference is now made to alluvial landforms, of valley floor areas which include the channel, active floodplain, and terraces.

One commentator suggested that all lands within the 100 year floodplain be suggested as meeting the geomorphic criteria. Although the correlation of the 100 year floodplain and valley floor alluvial deposits is good for some areas, the correlation does not necessarily hold. Since the statutory definition of alluvial valley floor's relates to the geologic characteristics of valley floor material and not the flood hazard level of an area, the Department has not adopted the commentator's suggestion.

Channel size criteria

Two commentators questioned the suggestion that an identifiable stream channel be considered any channel indicated on a standard USGS 7.5 minute series topographic map or any channel at least 3 feet in bankfill width or 0.5 feet in bankfill depth. Another commentator suggested that difficulty would arise in measuring bankfill sizes. Most commentators recognize the need, however, to establish some channel size criteria, lest minor rills and gullies without any importance be identified. The guidelines have now been changed to reference the regulatory definition of "unconsolidated streamlaid deposits" (30 CFR 701.5) which includes reference to identifable channels as those 3 feet in bankfill width and 0.5 feet in bankfill depth. The Department feels, based on its staff's field experience, that no channels smaller than this size in the semiarid or arid west could have water available sufficient for flood irrigation.

Review of Williams (1979) indicates that there are numerous methods of taking bankfill channel measurements. Since the U.S. Geological Survey has not established a standard measurement procedure, the Department at this time simply suggests that a consistent method be used, without requiring the method to be used.

Ephemeral Streams

One commentator stated that valleys holding ephemeral streams are not alluvial valley floors. Flow in ephemeral streams is very infrequent and generally occurs at times when irrigation is not necessary. Thus, streamflow must be stored in order to be available when irrigation is needed - during the dry portions of the growing stream. It is argued that storage of water for irrigation was not included in the statutory definition of alluvial valley floors. (The Department has considered this argument previously, during development of the interim and permanent regulatory program and during development of the draft guidelines. The statutory definition of alluvial valley floors establishes that water must be available for floor irrigation, but does not specify how that water is to be made available. Mapping efforts completed prior to passage of the Act, and used as a basis for determining the impact of alluvial valley floor provisions on mining, designated numerous ephermal stream valleys as alluvial valley floors. In some regions, ephemeral streamflow is diverted by water spreading systems and does incrementally increase crop yield. The Department also finds that the terms flood irrigation applies to the method of water application and that storage of streamflow for later irrigation application is within the intent of the statutory definition.

Another commentator argued that storage on ephermeral streams is not an economically viable consideration. Although this case may be true in some regions, the system has been observed in others. It is the Department's intent to identify a storage/irrigation system as viable alternative if the system is used in the surrounding region.

Alluvial Fans

One commentator called for more detailed criteria for including or excluding terraces on alluvial fans. This commentator noted the importance of alluvial fans in recharging adjacent underlying alluvium. The Department recognizes the interrelationships of unconsolidated alluvial fan deposits and modern day stream courses but also recognizes the Congressional intent to not consider entire fan surfaces as alluvial valley floors. (Senate).

In an attempt to evaluate that area of most importance to a modern stream course, it is suggested that terraces of a modern stream be considered under alluvial valley floor previsions. To the degree that other parts of a fan are integrated hydrologically with modern terraces, they would be evaluated as adjacent areas. To a certain extent, site specific determinations will dictate alluvial valley floor determinations of complex alluvial fan deposits.

Width of Valley Floors

A large percentage of the commentators favored designating a mininmum width for alluvial valley floor mapping and establishing this width as a criteria mapping efforts at the earliest stage of the identification process. Thus, if areas met geographic and water availability criteria but were smaller than a specific size, they could be eliminated from further consideration. The suggestions of minimum width ranged from 50 feet total width to 100 on one side of the channel. Although it is difficult to establish any minimum width criteria because of the variability of western agricultural practices the utility of suggesting a minimum width is obvious.

The Department has determined based on the comments received that 50 feet represents a minimum average width of a valley which, if possessing the special characteristics of an alluvial valley floor, would be of some importance to a farm's general operation. The use of an area of this width might include cropping of hay with small farm equipment or use as important grazing land. These criteria will likely cause some grazing lands and some important wildlife areas to fall outside the area of a designated valley floor area. However, there are other environmental protection performance standards which still apply to even the narrowest of areas. For example, the capability of the land to support an equivalent vegetative cover (diverse, permanent, predominantly native) must be re-established, and the post-mining land use must be approved by the regulatory authority. The applicant is required to protect or support land uses, regardless of whether the land uses are conducted within an area designated as an alluvial valley floor.

The guidelines also suggest that if a state regulatory authority establishes a smaller minimum width, based on the distinctive use of patterns of a given local area, that studies adopt this revised area.

Flood Irrigation Assessment

Numerous comments were received regarding the proposed guidance procedure for identifying flood irrigable areas. Essentially, the proposed guidance had stated that flood irrigable areas were to be identified as: 1) those areas which met the geomorphic characteristics of alluvial valley floors, and 2) were those areas where water of sufficient quality and quantity existed so that irrigation could be undertaken with beneficial crop yield results and without detrimental impacts to soils. The nature of comments varied.

One commentator maintained that the only irrigable land was already irrigated. Thus, the concept of irrigable, but presently unirrigated, land is invalid. Another commentator argued that the issue of irrigability of lands should be tied directly to the economic viability of such proposals and that detailed hydrologic studies are unnecessary. Other industry commentators stated that irrigability assessments, and overall alluvial valley floor assessments, should be heavily based on land use patterns or on "prudent man" concepts.

Specific comments on the detailed study criteria included: (1) suggestions to use area-wide hydrologic data for water yield estimates, rather than site specific, stream gaging data as suggested in the proposed Guidelines, (2) development of justification for a 2 acre-feet per acre standard for water sufficiency for irrigation (6 acre-feet per acre was suggested as an alternative by one commenter), and (3) consideration of the time of water availability.

The Department interprets the statutory language regarding alluvial valley floors (Subsection 510) as mandating the identification of irrigable land as well as irrigated land. Only with this assessment can alluvial valley floors be insured against having mining preclude use of alluvial valley floors.

The Department agrees that land use data should play a more important role in establishing irrigability of lands and therefore has redeveloped Part I. The Department thus now suggests that regional flood irrigation practices and patterns be evaluated. Unirrigated terraces in the permit area or adjacent area would be considered potentially irrigable (for purposes of Part I) if similar terraces, in terms of physiography, hydrology, soils and other factors, are irrigated in the region. To conclusively show that a terrace is irrigable, (under Part II), however, the Department still feels that water yield and quality, and soils data must demonstrate that irrigability. The major effect of the irrigability assessment revision is to reduce the area where detailed hydrologic and soils data are evaluated. The Department proposes to investigate irrigability only on those areas identified as being consistent with regional flood irrigation practices.

Consistent with its concern that flood irrigability assessments be consistent with regional irrigation practices, the Department now feels that standards for water application should be consisted with regional practice. The two acre-feet of water per acre of land criteria is a sound average water requirement for successful irrigation in the west and can be used until more regionally specific data area developed.

Commentors have suggested that available water be evaluated only if it could be delivered during maximum moisture stress periods. The Department agrees that the stress period is the time when irrigation waters should be applied and do the most good, however, general water spreading and flood irrigation practice in the west seeks to utilize all available streamflow, whenever delivered. The Department will consider delivery consistent with regional practices. The Department would not consider an area irrigable if water quality data or solids data indicate that long-term degradation of the soil resource would result in a manner that reduces the agricultural utility of the area.

The Department feels that the assessment of regional irrigation practices is a sufficient method for considering the economic viability of irrigability evaluations. Detailed cost/benefit analyses would be costly and only specific to the immediate economic climate. As a surrogate, and less involved procedure, the Department feels that an assessment of the types, extent, and locations of current and historically successful flood irrigation practices is to establish the kinds of areas where irrigation can be economically practiced.

One commentor suggested that when investigating the historical use of lands for flood irrigation, all historic time periods of use, regardless of date be evaluated. This suggestion has been accepted with the provision that historical use should not be used as a basis of establishing irrigability if the use had been discontinued because of general lack of success with the project.

Two Acre-Feet Water Availability Suggestion

Numerous commentors criticized the suggestion that two acre-feet be established as a general guide for the amount of water needed for successful irrigation. In light of the regional variations in this guide, the Department now suggests that water availability be based on water use requirements characteristic of the region where the assessment is made.

Consideration of the Legal Availability of Water in Availability Assessments

Some commentors suggested that flood irrigability assessements consider the legal availability of water as well as the physical availability. The Department recognizes that legal conditions constrain irrigation throughout the West. However, alluvial valley floors are areas that may have the potential for irrigation, and that potential might be exercised at a later time when legal rights become available for a site. By not considering legal issues, the Department fully protects the potential of lands.

Identification of marsh and bog areas

One commentor suggested that marsh and bog areas, such as those of North Dakota, qualify as AVF based on their water availability characteristics. The Department, recoginzing the statutory emphasis on the agricultural importance of AVF's, does not feel that subirrigated areas, per se, qualify as AVF's. The subirrigated vegetation of a site should also be agriculturally useful. At the sites in question in this paragraph, although important for wildlife, the agricultural use of the areas is minimal.

Sprinkler Irrigation

A few commentors raised the possibility of including sprinkler irrigation as an acceptable substitute for flood irrigation in assessing water availability. Although not specifically stated in the Guidelines, gravity-fed sprinklers that are supplied water pumped from the stream at the site (when it is determined that pumping is by choice of the farm operator as an alternative to equally feasible diversion) are acceptable substitutes for diversion and ditch irrigation. Water used should be obtained from a surface water supply and is not pumped directly from a ground water supply. The Department feels that this is a reasonable approach to the issue and considered sprinkler irrigation where it simulates or makes more efficient traditional flood irrigation practices. This discussion is now included in the Guideline.

Designation of Irrigable Areas

The Department has recognized the uncertainity amongst commentors in understanding the geographic extent of irrigability assessments. Questions arise concerning the designation of terrace levels as irrigable in the situation where water is shown to be available for only a portion of a terrace level. Since it is unable to identify which part of a terrace might be chosen for irrigation, the Department feels that the entire terrace surface possessing the irrigable characteristic should be established as an AVF.

Artificial Subirrigation

Two commentors suggested that the Guideline recommendation that the exclusion of artificial subirrigation as a basis for detemining water availability be eliminated. Artificial subirrigation is understood to be subirrigation caused by such man-induced features as seepage from dam and ditches and the raising of the water table above impoundments. The commentators stated that it is often difficult to distinguish artificial and natural irrigation.

The Department recognizes that the definition of alluial valley floors in Section 701(1) of the Act does not distinguish between natural and artificial subirrigation. However, in Section 510(b)(5)(A), the adverb "naturally" modifies "subirrigated." Thus, Congress concluded that it was necessary to distinguish natural from artificial subirrigation for purposes of determining significance of an AVF to agriculture. However, the distinction is not relevant to identifying alluvial valley floors since, the distinction is not found in the statutory definition. Thus, the Guidelines have been revised to eliminate discussions of artificial subirrigation in Parts I and II. Studies suggested in Part III, however, do not seek to distinguish the two types of subirrigation, however.

Depth of Water for Subirrigation

Two commentors requested that a maximum depth to ground-water be established, below which, if ground-water were encountered, it could be assessed that subirrigation could not exist. The benefit of establishing such a depth limit is that subirrigation of a valley floor could be ascertained by simply monitoring ground-water levels. Studies of soil molting, sooting depth, or daily water table fluctuations might therefore be unnecessary.

The suggestion is an excellent one, but insufficient data exist at this time to establish region wide limits, applicable to all western states. Some studies do exist, such as that of Dolloph (1979) who found that when ground-water depths exceeded 20 feet, alfalfa was entirely dependent on precipitation. Dollhoph (1979) also found that when ground-water depths exceeded 12 feet subirrigation had a negligible effect on alfalfa growth. Wheat yields were found to increase when ground-water levels were within 5.5 feet of ground surface. (Dollhoph, 1979). Similar studies for other crops or

subirrigation. In the event two crops are produced in a region, the Department would expect that limits be established reflecting the greatest depth to which ground water would be expected to result in subirrigation.

Extensive Nature of Detailed Studies

A major issue discussed by commentors was that the studies suggested in Part III of the Guidelines are only extensive and costly. The revised Guidelines now include cross-references to other portions of adopted regulations which already require most of the extent and detail of suggested studies in Part III. The suggestions of Part III add some guidance to how studies ought to be carried out but do not significantly add to the extent of studies already required.

The suggestions of Part III vary depending on whether a subirrigated alluvial valley floor or a flood irrigated alluvial valley floor is to be evaluated. The suggestions also vary depending on the location of an alluvial valley floor - within an affected area or located in other parts of the permit area or in the adjacent area. The kinds of study suggested of alluvial valley floors in affected areas are more detailed than those in adjacent areas because "affected" alluvial valley floors must be restored and reclaimed.

Those portions of Part III which represent important additions to study requirements contained in regulation concern detailed geomorphic studies, economic and productivity studies to be used in determining significance of agricultural lands, detailed geologic and hydrologic cross-sections of valley floors, and some mapping efforts. In light of the regulatory authority's necessity to make the writtten findings required in 30 CFR 785.19(e), it is important that sufficient data be available on which to base findings. The suggestions of Part III are felt to reasonably supply that information.

One commentator alleged that alluvial valley floor studies would significantly increase the costs of environmental studies. The Department's evaluation of this comment reveals that the costs of alluvial valley floor studies are not distinguished from those necessitated by other hydrologic sections of the Act, such as evaluation of the hydrologic balance of an area. Given the fact that about three-fourths of the studies suggested in Part III are also required in regulation under non-alluvial valley floor issues, the Deparment does not feel that Part III suggests studies of an onerous act.

Another commentator requested that greater flexibility be recognized in the Part III studies. In one sense the entire Guidelines recognize that flexibility, in that the document is a guideline and not a regulation. However, the Department has also endeavored to revise Part III to recognize the site-specific nature of environmental studies. The Department hopes that the studies of Part III will be carried out in the manner described, however, it recognizes that specific conditions may affect the conduct of these studies.

Requirements for a full year of hydrologic data

Several commentators recommended that a full year of hydrologic data not be suggested in the detailed study portion of the guidelines. This commentator stated that other methodology exists to characterize a typical hydrologic year. The Department never intended that a full year's data be collected in all cases. Rather, the Department suggests that the annual variability in water quantity and quality be characterized by means including, but not limited to, a full year's stream gaging or ground water observation. Therefore, the Department decided to more clearly state its suggestion in Part III that description of a full hydrologic year's conditions do not necessarily require gaging and sampling for a full year.

Other comments related to the suggestion that all streams be continuously gaged, whether perennial, intermittent, or ephemeral. In light of difficulties in gaging ephemeral streams whose flow is exceedingly flashy, the suggestion has been modified to suggest some method be developed to estimate annual peak and total flow.

Estimates of Erosion Rates and Sediment Field

One commentator suggested that references to estimates of erosion rates and sediment yields from affected areas should be dropped since other requirements of the Act controlled the quality of waters discharged from a permit area. This observation is correct, however, the effluent standards for runoff from reclaimed areas relates to the nature of sediment yield from natural hillslopes. Although suggested data should be collected to meet other provisions of regulation, the estimation of these factors is also important in assessing impacts to AVF's to be mined or affected, and thus is included in this part.

Accuracy of Water Level Measurements

One commentator suggested that water level measurements performed to an accuracy of 0.01 foot, as suggested, was an excessively detailed suggestion. Also, it was maintained that fluctuations observed at this accuracy could not be distinguished from monitoring fluctuations caused by barometric pressure responses. The suggested level of accuracy is achievable with a standard steel tape and is also a standard division on most chart recorders. Barometric pressure effects can be separated from other effects, and changes observed at this level of accuracy are an excellent indicator that evaportranspiration is depleting ground-water during daytime hours. The latter condition is an indicator of subirrgation. Therefore, it ws decided to retain the 0.01 foot suggestion.

ALLUVIAL VALLEY FLOOR GUIDELINES

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INTRODUCTION

Consideration by the Congress of the effect of surface coal mining on alluvial valley floors in western valleys was prompted by a statement in a report issued in 1974 by the National Academy of Sciences:

> "In the planning of any proposed mining and rehabilitation it is essential to stipulate that alluvial valley floors and stream channels be preserved. The unconsolidated alluvial deposits are highly susceptible to erosion as evidenced by the erosional history of many western valleys which record several periods of trenching in the past several thousand years ... removal of alluvium from the thalweg of the valley not only lowers the water table but also destroys the protective vegetation cover by draining soil moisture. Rehabilitation of trenched valley floors would be a long and expensive process and in the interim these highly productive grazing areas would be removed from use." (National Academy of Sciences, 1974, pp. 44-45)

In considering alluvial valley floors, the Congress recognized the special role of such areas in maintaining an agricultural economy in the western states. The role of alluvial floors in western agriculture was expressed as follows:

> "Of special importance in the arid and semiarid coal mining areas are alluvial valley floors which are the productive lands that form the backbone of the agricultural and cattle ranching economy in these areas. For instance, in the Powder River Basin of eastern Montana and Wyoming, agricultural and ranching operations which form the basis of the existing economic system of the region, could not survive without hay production from the naturally subirrigated and flood irrigated meadows located on the alluvial valley floors." (House of Representatives, 1977, p. 116)

The Surface Mining Control and Reclamation Act of 1977

Congress ultimately defined alluvial valley floors and provided specifically for their protection so that the use of these lands would not be interrupted or precluded by mining. The statutory definition of alluvial valley floors is included in Section 701(1) of the Surface Mining Control and Reclamation Act of 1977:

> "alluvial valley floors" means the unconsolidated stream laid deposits holding streams where water availability is sufficient for subirrigation or flood irrigation agricultural activities but does not include upland areas which are generally overlain by a thin veneer of colluvial deposits composed chiefly of debris from sheet erosion, deposits by unconcentrated runoff or slope wash, together with talus, other mass movement accumulation and windblown deposits. (PL 95-87, 701(1)).

The Act established criteria for permit approval or denial, which in part involve alluvial valley floors:

> (b) No permit or revision application shall be approved unless the application affirmatively demonstrates and the regulatory authority finds in writing on the basis of the information set forth in the application or from information otherwise available which will be documented in the approval and made available to the applicant that ... (5) the proposed surface coal mining operation, if located west of the one hundredth meridian west longitude, would (A) not interrupt, discontinue, or preclude farming on alluvial valley floors that are irrigated or naturally subirrigated, but, excluding undeveloped range lands which are not significant to farming on said alluvial valley floors and those lands as to which the regulatory authority finds that if the farming that will be interrupted, discontinued, or precluded is of such small acreage as to be of negligible impact on the farm's agricultural production, or (B) not materially damage the quantity or quality of water in surface or underground water systems that supply these valley floors in (A) of subsection (b)(5).

The Act also established environmental protection performance standards which in part involve alluvial valley floors:

> (b) General performance standards shall be applicable to all surface coal mining and reclamation operations and shall require the operation as a minimum to ... (10) minimize the disturbances to the prevailing hydrologic balance at the mine-site and in associated offsite areas and to the quality

and quantity of water in surface and ground water systems both during and after surface coal mining operations and during reclamation by ... (F) preserving throughout the mining and reclamation process the essential hydrologic functions of alluvial valley floors in the arid and semi-arid areas of the country. (PL 95-87, 515)

Permanent Regulatory Program

In order to implement the requirements of the Act, regulations were developed (U.S. Department of the Interior, 1979). Generally, requirements for permits for surface coal mining and reclamation operations on areas or adjacent to areas including alluvial valley floors in the arid or semi-arid areas west of the 100th meridian are included in 30 CFR 785.19. Special performance standards for operations involving alluvial valley floors are included in 30 CFR 822. Definitions of some terms important to these regulations are included in 30 CFR 701.5.

The permit requirements outlined in 30 CFR 785.19 apply to all surface coal mining operations, in the arid or semi-arid western states and also address the surface affects of underground mining:

> (a) Scope. This Section applies to each person who conducts or intends to conduct surface coal mining and reclamation operations in, adjacent to or under a valley holding a stream in the arid or semi-arid regions of the United States west of the 100th meridian.
>
> (b) No person shall engage in surface coal mining and reclamation operations subject to this Section, except under a permit issued by the regulatory authority in accordance with this Section. (30 CFR 785.19(a),(b))

The Regulations outline general procedures and information necessary to permit a regulatory authority determination of the status of lands as alluvial valley floors:

"(c) Alluvial valley floor determination.

"(1) Before applying for a permit to conduct, or before conducting surface coal mining and reclamation operations within a valley holding a stream or in a location where the adjacent area includes any stream in the arid or semi-arid regions of the United States, the applicant shall either affirmatively demonstrate, based on available data, the presence of an alluvial valley floor, or submit to the regulatory authority the results of a field investigation of the proposed mine plan area and adjacent area. The field investigations shall include sufficiently detailed geologic, hydrologic, land use, soils, and vegetation studies on areas required to be investigated by the regulatory authority, after consultation with the applicant, to enable the regulatory authority to make an evaluation regarding the existence of the probable alluvial valley floor in the proposed mine plan area or adjacent area and to determine which areas, if any, require more detailed study in order to allow the regulatory authority to make a final determination regarding the existence of an alluvial valley floor. Studies performed during the investigation by the applicant or subsequent studies as required of the applicant by the regulatory authority, shall include an appropriate combination, adapted to site-specific conditions, of --

"(i) Mapping of unconsolidated stream-laid deposits holding streams including, but not limited to, geologic maps of unconsolidated deposits, and stream-laid deposits, maps of streams, delineation of surface watersheds and directions of shallow ground water flows through and into the unconsolidated deposits, topography showing local and regional terrace levels, and topography of terraces, flood plains and channels showing surface drainage patterns.

"(ii) Mapping of all lands included in the area in accordance with this paragraph and subject to agricultural activities, showing the area in which different types of agricultural lands, such as flood irrigated lands, pasture lands and undeveloped rangelands, exist, and accompanied by measurements of vegetation in terms of productivity and type.

"(iii) Mapping of all lands that are currently or were historically flood irrigated, showing the location of each diversion structure, ditch, dam and related reservoir, irrigated land, and topography of those lands.

"(iv) Documentation that areas identified in this paragraph are, or are not, subirrigated, based on ground water monitoring data, representative water quality, soil moisture measurements, and measurements of rooting depth, soil mottling, and water requirements of vegetation.

"(v) Documentation, based on representative sampling, that areas identified under this paragraph are, or are not, flood irrigable, based on streamflow, water quality, water yield, soils measurements, and topographic characteristics.

"(vi) Analysis of a series of aerial photographs, including color infrared imagery flown at a time of year to show any late summer and fall differences between upland and valley floor vegetative growth and of a scale adequate for reconnaissance identification of areas that may be alluvial valley floors.

"(2) Based on the investigations conducted under 30 CFR 785.19(c)(1), the regulatory authority shall make a determination of the extent of any alluvial valley floors within the study area and whether any stream in the study area may be excluded from further consideration as lying within an alluvial valley floor. The regulatory authority shall determine that an alluvial valley floor exists if it finds that —

"(i) Unconsolidated streamlaid deposits holding streams are present; and,

"(ii) There is sufficient water to support agricultural activities as evidenced by:

"(A) The existence of flood irrigation in the area in question or its historical use;

"(B) The capability of an area to be flood irrigated, based on stream-flow water yield, soils, water quality, and topography; or,

"(C) Subirrigation of the lands in question, derived from the ground water system of the valley floor."

If alluvial valley floors are identified in or adjacent to a proposed permit area, a mining and reclamation permit application must include certain types of information:

"(d) Application contents for operations affecting designated alluvial valley floors.

"(1) If land within the proposed permit area or adjacent area is identified as an alluvial valley floor and the proposed mining operation may affect an alluvial valley floor or waters that supply alluvial valley floors, the applicant shall submit a complete application for the proposed mining and reclamation operations, to be used by the regulatory authority, together with other relevant information, including the information required by Paragraph (c) of this Section, as a basis for approval or denial of the permit. The complete application shall include detailed surveys and baseline data required by the regulatory authority for a determination of —

"(i) The characteristics of the alluvial valley floor which are necessary to perserve the essential hydrologic functions during and after mining;

"(ii) The significance of the area to be affected to agricultural activities;

"(iii) Whether the operation will cause, or presents an unacceptable risk of causing, material damage to the quantity or quality of surface or ground waters that supply the alluvial valley floor;

"(iv) The effectiveness of proposed reclamation with respect to requirements of the Act, this Chapter and the regulatory program; and

"(v) Specific environmental monitoring, required to measure compliance with 30 CFR 822 during and after mining and reclamation operations.

"(2) Information required under this paragraph shall include, but not be limited to --

"(i) Geologic data, including geologic structure, and surficial geologic maps, and geologic cross-sections;

"(ii) Soils and vegetation data, including a detailed soil survey and chemical and physical analyses of soils, a vegetation map and narrative descriptions of quantitative and qualitative surveys, and land use data, including an evaluation of crop yields;

"(iii) Surveys and data required under this paragraph for areas designated as alluvial valley floors because of their flood irrigation characteristics shall also include, at a minimum, surface hydrologic data, including streamflow, runoff, sediment yield, and water quality analyses describing seasonal variations over at least 1 full year, field geomorphic surveys and other geomorphic studies;

"(iv) Surveys and data required under this paragraph for areas designated as alluvial valley floors because of their subirrigation characteristics, shall also include, as a minimum, geohydrologic data including observation well establishment for purposes of water level measurements, ground water contour maps, testing to determine aquifer characteristics that affect waters supplying the alluvial valley floors, well and spring inventories, and water quality analyses describing seasonal variations over at least 1 full year, and physical and chemical analysis of overburden to determine the effect of the proposed mining and reclamation operations on water quality and quantity;

"(v) Plans showing how the operation will avoid, during mining and reclamation, interruption, discontinuance or preclusion of farming on the alluvial valley floors unless the premining land use has been undeveloped rangeland which is not significant to farming and will not materially damage the quantity or quality of water in surface and ground water systems that supply alluvial valley floors;

"(vi) Maps showing farms that could be affected by the mining and, if any farm includes an alluvial valley floor, statements of the type and quantity of agricultural activity performed on the alluvial valley floor and its relationship to the farm's total agricultural activity including an economic analysis.

"(vii) Such other data as the regulatory authority may require.

"(3) The surveys required by this paragraph should identify those geologic, hydrologic, and biologic characteristics of the alluvial valley floor necessary to support the essential hydrologic functions of an alluvial valley floor. Characteristics which support the essential hydrologic functions and which must be evaluated in a complete application include, but are not limited to:

"(i) Characteristics supporting the function of collecting water which include, but are not limited to --

"(A) The amount and rate of runoff and a water balance analysis, with respect to rainfall, evapotranspiration, infiltration and ground water recharge;

"(B) The relief, slope, and density of the network of drainage channels;

"(C) The infiltration, permeability, porosity and transmissivity of unconsolidated deposits of the valley floor that either constitute the aquifer associated with the stream or lie between the aquifer and the stream; and

"(D) Other factors that affect the interchange of water between surface streams and ground water systems, including the depth to ground water, the direction of ground water flow, the extent to which the stream and associated alluvial ground water aquifers provide recharge to, or are recharged by bedrock aquifers.

"(ii) Characteristics supporting the function of storing water which include, but are not limited to --

"(A) Surface roughness, slope, and vegetation of the channel, flood plain, and low terraces that retard the flow of surface waters;

"(B) Porosity, permeability, waterholding capacity, saturated thickness and volume of aquifers associated with streams, including alluvial aquifers, perched aquifers, and other water bearing zones found beneath valley floors; and

"(C) Moisture held in soils or the plant growth medium within the alluvial valley floor, and the physical and chemical properties of the subsoil that provide for sustained vegetation growth or cover during extended periods of low precipitation.

"(iii) Characteristics supporting the function of regulating the flow of water which include, but are not limited to --

"(A) The geometry and physical character of the valley, expressed in terms of the longitudinal profile and slope of the valley and the channel, the sinuosity of the channel, the cross-section, slopes and proportions of the channels, flood plains and low terraces, the nature and stability of the stream banks and the vegetation established in the channels and along the stream banks and flood plains;

"(B) The nature of surface flows as shown by the frequency and duration of flows of representative magnitude including low flows and floods; and

"(C) The nature of interchange of water between streams, their associated alluvial aquifers and any bedrock aquifers as shown by the rate and amount of water supplied by the stream to associated alluvial and bedrock aquifers (i.e., recharge) and by the rates and amounts of water supplied by aquifers to the stream (i.e., baseflow);

"(iv) Characteristics which make water available and which include, but are not limited to —

"(A) The presence of land forms including flood plains and terraces suitable for agricultural activities."

Based on the application information and any other information obtained by the regulatory authority, findings must be made regarding the impacts of mining and reclamation operations on the alluvial valley floor(s) in question:

"(e)(1) No permit or permit revision application for surface coal mining and reclamation operations on lands located west of the one hundreth meridian west longtitude, shall be approved by the regulatory authority, unless the application demonstrates and the regulatory authority finds in writing, on the basis of information set forth in the application that —

"(i) The proposed operations would not interrupt, discontinue, or preclude farming on an alluvial valley floor, unless the premining land use has been undeveloped range land which is not significant to farming on the alluvial valley floor, or unless the area of an affected alluvial valley floor is small and provides, or may provide, negligible support for production of one or more farms; provided, however, this subparagraph does not apply to those lands which were identified in a reclamation plan approved by the State prior to August 3, 1977, for any surface coal mining and reclamation operation that, in the year preceding August 3, 1977 —

"(A) Produced coal in commerical quantities and was located within or adjacent to alluvial valley floors; or

"(B) Obtained specific permit approval by the State regulatory authority to conduct surface coal mining and reclamation operations within an alluvial valley floor.

"(ii) The proposed operations would not materially damage the quantity and quality of water in surface and underground water systems that supply those alluvial valley floors or portions of alluvial valley floors which are —

"(A) Included in clause (1)(i) of this paragraph (e); or

"(B) Outside the permit area of an existing or proposed surface coal mining operation.

"(iii) The proposed operations would be conducted in accordance with 30 CFR 822 and all other applicable requirements of the Act, this Chapter and the regulatory program; and,

"(iv) Any change in the land use of the lands covered by the proposed mine plan area from its premining use in or adjacent to alluvial valley floors will not interfere with or preclude the reestablishment of the essential hydrologic functions of the alluvial valley floor.

"(2) The significance of the impact of the proposed operations on farming will be based on the relative importance of the vegetation and water of the developed grazed or hayed alluvial valley floor area to the farm's production, or any more stringent criteria established by the regulatory authority as suitable for site-specific protection of agricultural activities in alluvial valley floors. The effect of the proposed operations on farming will be concluded to be significant if they would remove from production, over the life of the mine, a proportion of the farm's production that would decrease the expected annual income from agricultural activities normally conducted at the farm.

"(3) Criteria for determining whether a surface coal mining operation will materially damage the quantity or quality of water subject to clauses (i)(ii) of this paragraph include, but are not limited to --

"(i) Potential increases in the concentration of total dissolved solids of waters supplied to an alluvial valley floor, as measured by specific conductance in millimhos, to levels above the threshold value at which crop yields decrease, as specified in Maas and Hoffman, "Crop Salt Tolerance -- Current Assessment," Table 1, "Salt Tolerance of Agricultural Crops," unless the applicant demonstrates compliance with paragraph (ii).

"(A) Salt tolerances for agricultural crops have been published by E. V. Maas and G. J. Hoffman, in a paper titled "Crop Salt Tolerance -- Current Assessment" contained in The Jounal of The Irrigation and Drainage Division, American Society of Civil Engineers, pages 115 through 134, June, 1977. Table 1, giving threshold salinity values is presented on pages 22 through 125.

"(B) This publication is hereby incorporated by reference as it exists on the date of adoption of this Part. Notices of changes made to this publication will be periodically published by the Office of Surface Mining in the Federal Register. The Maas and Hoffman publication is on file and available for inspection at the OSM Central Office, U. S. Department of Interior, South Interior Building, Washington, D.C. 20240, at each OSM Regional Office, and at the central office of State regulatory authorities located west of the 100th meridian, west longitude. Copies of the publication may also be obtained by writing to the above locations. A copy of this publication will also be on file for public inspection at the Federal Register Library, 1100 L Street N.W., Washington, D.C. Incorporation by reference provisions approved by the Director of the Federal Register on February 7, 1979. The Director's approval of this incorporation by reference expires on February 7, 1980.

"(ii) Potential increases in the concentration of total dissolved solids of waters supplied to an alluvial valley floor in excess of those incorporated by reference in paragraph (i) shall not be allowed unless the applicant demonstrates, through testing related to the production of crops grown in the locality, that the proposed operations will not cause increases that will result in crop yield decreases.

"(iii) For types of vegetation not listed in Maas and Hoffman as specified by the regulatory authority, based

upon consideration of observed correlation between total dissolved solid concentrations in water and crop yield declines, taking into account the accuracy of the correlations.

"(iv) Potential increases in the average depth to water saturated zones (during the growing season) located within the root zone of the alluvial valley floor that would reduce the amount of subirrigation land compared to pre-mining conditions;

"(v) Potential decreases in surface flows that would reduce the amount of irrigable land compared to pre-mining conditions; and

"(vi) Potential changes in the surface or ground water systems that reduce the area available to agriculture as a result of flooding or increased saturation of the root zone.

"(4) For the purposes of this paragraph, a farm is one or more land units on which agricultural activities are conducted. A farm is generally considered to be the combination of land units with acreage and boundaries in existence prior to August 3, 1977, or, if established after August 3, 1977, with those boundaries based on enhancement of the farm's agricultural productivity and not related to surface coal mining operations."

Thus, it is necessary to evaluate at a minimum the permit area and adjacent area for the presence of alluvial valley floors. A regulatory decision regarding the existence of alluvial valley floors must be obtained and the alluvial valley floors sufficiently studied so that the impacts of a proposed mining and reclamation operation can be evaluated in the permit review process.

The requirements for surface coal mining and reclamation operations, alluvial valley floor lands or on lands where activity may affect alluvial valley floors are outlined in 30 CFR 822:

"§ 822.1 Scope.

This Part sets forth additional requirements for surface coal mining and reclamation operations on or which affect alluvial valley floors in the arid and semi-arid regions of the country.

"§ 822.2 Objectives.

This Part establishes the minimum environmental protection performance, reclamation and design standards, to preserve either the existing or potential agricultural uses and the productivity of alluvial valley floors during and after surface coal mining and reclamation operations."

These requirements outline the general standards for mining and reclamation operations to preserve or reestablish the essential hydrologic functions of alluvial valley floors:

> "(a) Surface coal mining and reclamation operations shall be conducted to preserve, throughout the mining and reclamation process, the essential hydrologic functions of alluvial valley floors not within an affected area. These functions shall be preserved by maintaining those geologic, hydrologic and biologic characteristics that support those functions.
>
> "(b) Surface coal mining and reclamation operations shall be conducted to reestablish, throughout the mining and reclamation process, the essential hydrologic functions of alluvial valley floors within an affected area. These functions shall be reestablished by reconstructing those geologic, hydrologic and biologic characteristics that support those functions.
>
> "(c) The characteristics that support the essential hydrologic functions of alluvial valley floors are those in 30 CFR 785.19(d)(3) and those other geologic, hydrologic, or biologic characteristics identified during premining investigations or monitoring conducted during the surface coal mining and reclamation operation."

Surface coal mining and reclamation operations must also protect farming on, and water supplies of, alluvial valley floors:

> "(a) Surface coal mining and reclamation operations shall not interrupt, discontinue, or preclude farming on alluvial valley floors, unless --
>
> > "(i) The premining land use is undeveloped rangeland which is not significant to farming; or
> >
> > "(ii) The area of affected alluvial valley floor is small and provides or may provide negligible support for production from one or more farms.
>
> "(b) If environmental monitoring shows that a surface coal mining operation is interrupting, discontinuing, or precluding farming on alluvial valley floors, the operation shall cease until remedial measures are taken by the person who conducts the operation. The remedial measures shall be approved by the regulatory authority prior to the resumption of mining.
>
> "(c) Surface coal mining and reclamation operations shall not cause material damage to the quality or quantity of water in surface or underground water systems that supply alluvial valley floors. If environmental monitoring shows that the surface coal

"mining operation is causing material damage to water that supplies alluvial valley floors, the mining operations shall cease until remedial measures are taken by the person who conducts the operation. The remedial measures shall be approved by the regulatory authority prior to the resumption of mining operations.

"(d) Paragraphs (a) and (b) of this Section do not apply to those lands which were identified in a reclamation plan approved by the State prior to August 3, 1977 for any surface coal mining and reclamation operation that, in the year preceding August 3, 1977:

"(1) Produced coal in commercial quantities and was located within or adjacent to an alluvial valley floor, or

"(2) Obtained specific permit approval by the State regulatory authority to conduct surface coal mining and reclamation operations within an alluvial valley floor."

Agricultural uses of alluvial valley floors must also be protected:

"Surface coal mining and reclamation operations shall be conducted to ensure that the agricultural utility and the level of productivity of alluvial valley floors in affected areas are reestablished."

In order to ensure compliance with these performance standards, monitoring must document environmental conditions:

"(a) An environmental monitoring system shall be installed, maintained and operated by the permittee on all alluvial valley floors during surface coal mining and reclamation operations and continued until all bonds are released in accordance with 30 CFR 807. The monitoring system shall provide sufficient information to all the regulatory authority to determine that:

"(i) The agricultural utility and production of the alluvial valley floor not within the affected area is being preserved;

"(ii) The potential agricultural utility and production on the alluvial valley floor within the affected area has been reestablished;

"(iii) The important characteristics supporting the essential hydrologic functions of the alluvial valley floor in the affected area have been reestablished after mining; and

"(iv) The important characteristics supporting the essential hydrologic functions of an alluvial valley floor in areas not affected are preserved during and after mining.

"(b) Monitoring shall be performed at adequate frequencies, to indicate long term trends that could affect agricultural use of the alluvial valley floors.

"(c) Monitoring shall be performed during operations, to identify characteristics of the alluvial valley floor not identified in the permit application and to evaluate the importance of all characteristics.

"(d) All monitoring data collected and analyses thereof shall routinely be made available to the regulatory authority."

Several terms important to the alluvial valley floor regulations are defined in regulation:

" **Agricultural activities** means, with respect to alluvial valley floors, the use of any tract of land for the production of animal or vegetable life, where the use is enhanced or facilitated by subirrigation or flood irrigation associated with alluvial valley floors. These uses include, but are not limited to, the pasturing, grazing, or watering of livestock, and the cropping, cultivation, or harvesting of plants whose production is aided by the availability of water from subirrigation or flood irrigation. Those uses do not include agricultural practices which do not benefit from the availability of water from subirrigation or flood irrigation."

" **Agricultural use** means the use of any tract of land for the production of animal or vegetable life. The uses include, but are not limited to, the pasturing, grazing, and watering of livestock, and the cropping, cultivation, and harvesting of plants."

" **Arid and semiarid area** means, in the context of alluvial valley floors, an area of the interior western United States, west of the 100th meridian west longitude, experiencing water deficits, where water use by native vegetation equals or exceeds that supplied by precipitation. All coal fields located in North Dakota west of the 100th meridian west longitude, all coal fields in Montana, Wyoming, Utah, Colorado, New Mexico, Idaho, Nevada, and Arizona, the Eagle Pass field in Texas, and the Stone Canyon and the Ione fields in California are in arid and semiarid areas."

" **Essential hydrologic functions** means the role of an alluvial valley floor in collecting, storing, regulating, and making the natural flow of surface or ground water, or both, usefully available for agricultural activities by reason of the valley floor's topographic position, the landscape and the physical properties of its underlying materials. A combination of these functions provides a water supply during extended periods of low precipitation."

"(a) The role of the valley floor in collecting water includes accumulating runoff and discharge from aquifers in sufficient amounts to make the water available at the alluvial valley floor greater than the amount available from direct precipitiation.

"(b) The role of the alluvial valley floor in storing water involves limiting the rate of discharge of surface water, holding moisture in soils, and holding ground water in porous materials.

"(c)(1) The role of the alluvial valley floor in regulating the natural flow of surface water results from the characteristic configuration of the channel flood plain and adjacent low terraces.

"(2) The role of alluvial valley floor in regulating the natural flow of ground water results from the properties of the aquifers which control inflow and outflow.

"(d) The role of the alluvial valley floor in making water usefully available for agricultural activities results from the existence of flood plains and terraces where surface and ground water can be provided in sufficient quantities to support the growth of agriculturally useful plants, from the presence of earth materials suitable for the growth of agriculturally useful plants, from the temporal and physical distribution of water making it accessible to plants throughout the critical phases of the growth cycle either by flood irrigation or by subirrigation, from the natural control of alluvial valley floors in limiting destructive extremes of stream discharge, and from the erosional stability of earth materials suitable for the growth of agriculturally useful plants."

" **Flood irrigation** means, with respect to alluvial valley floors, supplying water to plants by natural overflow or the diversion of flows, so that the irrigated surface is largely covered by a sheet of water."

" **Materially damage the quantity or quality of water** means, with respect to alluvial valley floors, changes in the quality or quantity of the water supply to any portion of an alluvial valley floor where such changes are caused by surface coal mining and reclamation operations and result in changes that significantly and adversely affect the composition, diversity, or productivity of vegetation dependent on subirrigation, or which result in changes that would limit the adquacy of the water for flood irrigation of the irrigable land acreage existing prior to mining."

" **Subirrigation** means, with respect to alluvial valley floors, the supplying of water to plants from underneath or from a semi-saturated or saturated subsurface zone where water is available for use by vegetation. Subirrigation may be identified by:

"(a) Diurnal fluctuation of the water table, due to the differences in nighttime and daytime evapotranspiration rates;

"(b) Increasing soil moisture from a portion of the root zone down to the saturated zone, due to capillary action;

"(c) Mottling of the soils in the root zones;

"(d) Existence of an important part of the root zone within the capillary fringe or water table of an alluvial aquifer; or

"(e) An increase in streamflow or a rise in ground water levels, shortly after the first killing frost on the valley floor."

" **Unconsolidated streamlaid deposits holding streams** means, with respect to alluvial valley floors, all flood plains and terraces located in the lower portions of topographic valleys which contain perennial or other streams with channels that are greater than 3 feet in bankfull width and greater than 0.5 feet in bankfull depth."

" **Undeveloped rangeland** means, for purposes of alluvial valley floors, lands where the use is not specifically controlled and managed."

" **Upland areas** means, with respect to alluvial valley floors, those geomorphic features located outside the floodplain and terrace complex, such as isolated higher terraces, alluvial fans, pediment surfaces, landslide deposits, and surfaces covered with residuum, mud flows or debris flows, as well as highland areas underlain by bedrock and covered by residual weathered material or debris deposited by sheetwash, rillwash, or windblown material."

The requirements for alluvial valley floor evaluation in a study area, as outlined in 785.19(c), are also greater detail by regulatory definitions:

" **Mine plan area** means the area of land and water within the boundaries of all permit areas during the entire life of the surface coal mining and reclamation operations. At a minimum, it includes all areas which are or will be affected during the entire life of those operations. Other terms defined in this Section which relate closely to mine plan area are: (1) permit area,

which will always be within or the same as the mine plan area; (2) affected area, which will always be within or the same as the permit area; and (3) adjacent area, which may surround or extend beyond the affected area, permit area, or mine plan area."

" **Permit area** means the area of land and water within the boundaries of the permit which are designated on the permit application maps, as approved by the regulatory authority. This area shall include, at a minimum, all areas which are or will be affected by the surface coal mining and reclamation operations during the term of the permit."

" **Affected area** means, with respect to surface mining activities, any land or water upon or in which those activities are conducted or located. With respect to underground mining activities, **affected area** means: (i) any water or surface land upon or in which those activities are conducted or located; and (ii) land or water which is located above underground mine workings."

" **Adjacent area** means land located outside the affected area, permit area, or mine plan area, depending on the context in which **adjacent area** is used, where air, surface or ground water, fish, wildlife, vegetation or other resources protected by the Act may be adversely impacted by surface coal mining and reclamation operations."

Guidelines

These guidelines are designed to give greater definition to the Act and adopted regulations.

Although the statutory definition of alluvial valley floors establishes that the existence of a water supply sufficient for agricultural activities is a necessary characteristic of an alluvial valley floor, the Congress did not give quantitative criteria by which the adequacy of this supply for agricultural activities should be evaluated. These guidelines, in part, are designed to overcome this lack of specificity in evaluating water availability. The guidelines are also designed to provide uniform criteria for identification of alluvial valley floors in differing geographic areas.

These guidelines provide a sequential procedure for identifying and then studying alluvial valley floors. These guidelines provide a suggested evaluation process in which progressively more detailed information is obtained as the existence of alluvial valley floors becomes known. The Guidelines are structured with the intent of avoiding unnecessary data collection. Initially, regional or generalized data is used to identify probable alluvial valley floors. Detailed, site specific data then need be obtained only for areas of probable concern, while other areas may be discontinued from further alluvial valley floor study.

Thus this technical guidance paper contains a three part process comprised of reconnaissance investigation procedures for identification of probable alluvial valley floors and identification of lands clearly not alluvial valley floors (Part I), guidelines for intermediate study of potential alluvial valley floors leading to final designation of alluvial valley floors (Part II), and detailed studies necessary for submittal of a complete application for a permit area or adjacent area which includes an alluvial valley floor (Part III).

Figure 1 outlines the relative timing of each Part and the regulatory determinations that result from submittal of the data of each Part.

Regional and site specific diversity does not permit development of quantitative criteria for every important characteristic of alluvial valley floors. In many cases, it is likely that determinations and evaluations of alluvial valley floors will involve site-specific judgments by experienced personnel. This guideline provides guidance which is not a mandatory requirement, but is intended for use by State regulatory authorities and operators to achieve uniform application of alluvial valley floor provisions contained in statute and regulation. This Guideline will be used by the Office of Surface Mining as a guideline in its own evaluation of alluvial valley floor questions. In every case, the applicant for a permit to mine should consult with the appropriate regulatory authority prior to initiating a study of potential or designated alluvial valley floors. In some states, guidelines have also been developed by state regulatory authorities. These documents should be consulted.

Each of the following parts includes specifications for data collection. Presentations of data collected by proposed operators are best when accompanied by interpretative sections which synthesize collected data. These reports should include discussions of the interrelationships among hydrologic, geologic, pedologic, vegetative, and land use data.

PART I

Reconnaissance Investigation Procedures: Identification of probable Alluvial Valley Floors and Identification of Lands Clearly Not Alluvial Valley Floors

A. Purpose

Reconnaissance procedures are available which can establish that certain areas are not alluvial valley floors. If insufficient data exist to confirm that alluvial valley floors do not exist, then additional studies may be necessary to clarify the status of the questionable lands. These additional studies are described in Part II of this document. The intent of Part I is to give definition to 30 CFR 785.19(c)(1) which allows for preliminary identification of alluvial valley floors. The intent of a procedure for negative determination of alluvial valley floor status is to permit an applicant to dispense with further alluvial valley floor studies on lands clearly not meeting the statutory definition.

B. Timing

These reconnaissance identification procedures do not necessarily have to be conducted by the applicant. The applicant may be satisfied that the valleys in and adjacent to the proposed mine plan area may be or are alluvial valley floors. In this case, the applicant might immediately initiate the more detailed "Intermediate Studies" of the valleys outlined in Part II. However, if the studies included in Part I are to be carried out, they must be completed prior to submittal of a mining permit application (30 CFR 785.19(c)(1)). Because the "Intermediate Studies" (Part II) of probable alluvial valley floors and "Detailed Studies" (Part III) of designated alluvial valley floors must be performed prior to submittal of a complete permit application, it is suggested that the results of reconnaissance fieldwork be available prior to development of a baseline environmental monitoring program at a proposed site.

C. Study Area

As noted in the Introduction, a mine permit application must identify alluvial valley floors and the impacts of proposed mining and reclamation operations within the "adjacent area" as well as the "permit area". The adjacent area varies in arial extent with the environmental resource in question (see Introduction — Permanent Regulatory Program). For example, the area which "may be adversely affected" in terms of wildlife resources is different from the area which "may be adversely affected" in terms of soil resources. For purposes of alluvial valley floor studies, identification of an adjacent area in terms of ground water resources and an adjacent area in terms of surface water resources is necessary.

Eventually, the adjacent areas need to be defined based on site-specific estimates of drawdown impacts, changes in ground water quality, and surface water basins receiving runoff from mined or reclaimed areas. However, such data may not be available at this preliminary stage of mine plan development. It is initially left to the discretion of the applicant to choose an appropriate study area, but it is clear that it is to the applicant's benefit to initiate study on any lands which reasonably might be included in formally designated adjacent areas.

As one possible guide, and in the absence of other data at the reconnaissance level, areas two miles in radius about a mine plan area might be considered a potential ground water adjacent area. All valleys adjacent to the proposed permit area which will receive runoff from the proposed permit area could be included in the surface water adjacent area at this stage. Receiving streams could be studied downstream about two miles from the permit area or downstream to the point where a major tributary or other discharge enters the receiving stream and changes the stream's basic character.

D. Map Scale and Detail

For purposes of this Part, all mapping could be acceptably shown at a scale of 1:24000 or larger. Mapping should be conducted at the level of detail permitted by the map scale used.

E. Specific Study Components

To conclusively prove that an area is not an alluvial valley floor, it must be shown that the areas in question do not meet the geomorphic criteria or the water availability criteria of the statutory definition. As discussed in Part I.C. ("Study Area"), the land areas considered should include those within a ground water adjacent area, or those within a surface water adjacent area, or both. Studies should also include the proposed permit area.

Studies within the proposed permit area should examine flood irrigation and subirrigation water availability of all areas meeting the geomorphic characteristics of alluvial valley floors.

Studies within the ground water adjacent area should focus on identifying topographic valley floors which meet the geomorphic characteristics and the water availability characteristics of subirrigation.

Studies within the surface water adjacent area should focus on identifying topographic valley floors which meet the geomorphic characteristics and the water availability characteristics of flood irrigation.

1. Water Availability Characteristics -- Flood Irrigation

The existence of flood irrigation or the capability of lands to be flood irrigated can be evaluated in this Part principally through the use and extrapolation of land use data. All flood irrigated lands in the permit area and surface water adjacent area should be identified, as well as any lands flood irrigated in the past for which records are available. Any information available concerning the reasons why lands historically irrigated were discontinued from use would be helpful in later regulatory evaluations and can be submitted.

In order to evaluate flood irrigation capability, the pattern of flood irrigation in the region surrounding the permit area should be evaluated. In this effort, watersheds of similar physiographic, agricultural, geologic, climatic, hydrologic, soils, and vegetation characteristics could be identified. The region containing these watersheds might include a few counties or an area a few tens of miles about a permit area. Within this area, all current or historically successful flood irrigation areas could be identified. Flood irrigation in valleys with drainage basins of similar or smaller size could then be evaluated on site to determine the height above the channel of irrigated lands, the type of irrigation practiced, and other important site conditions. Following this regional evaluation, all lands in the surface water adjacent area or permit area with similar physical conditions would be identified as flood irrigable. For example, if the only flood irrigation practiced in an evaluated region occurred along perennial streams on terraces less than 15 feet above the adjacent stream channel, lands in the surface water adjacent area or permit area along intermittant and ephemeral streams would not be considered flood irrigable. If, on the other hand, it were found that regionally, flood irrigation was occasionally practiced in the valleys of ephemeral streams with drainage basins greater than 5 square miles, and on terraces less than 10 feet above the adjacent stream channel, than lands in the surface water adjacent area or permit area of a similar condition might be considered flood irrigable. The lands identified as flood irrigated or flood irrigable in the study area should also be evaluated in relation to the geomorphic characteristics described below.

For purposes of identifying flood irrigated lands, areas irrigated by gravity-fed sprinklers whose source is water from the neighboring stream can be identified as flood irrigation. Use of water from the adjacent stream could be by diversion or pumping, if diversions were equally feasible.

2. Water Availability Characteristics -- Subirrigation

Using the best available aerial photography and reconnaissance fieldwork, an experienced botanist or range scientist should identify all topographic valley floor lands where agriculturally useful vegetation is dependent on moisture supplied by ground water or frequent flood flows. Frequently, these areas can

be destinguished on colo infra-red photography taken in late summer. At this time of year, upland areas are usually dormant while lowland vegetation may still be growing, if water is available. Lands identified as potentially subirrigated should also be evaluated under the geomorphic characteristics described below.

3. Geomorphic Characteristics

The geomorphic characteristcs of flood irrigated, flood irrigable, or subirrigated lands should be evaluated in the study area, identifying the surface extent of all floodplains and/or terraces underlain by unconsolidated material, found in the lower parts of topographic valleys, in which are also found identifiable stream channels (channels that are greater than 3 feet in bankfull width and greater than 0.5 feet in bankfull width). The measurement of bankfull width and depth should be made in a standardized manner such as those suggested by Lowham (1976) or Hedman and Kastner (____). Williams (1979) has reviewed most measurement techniques and suggest the most favorable methods. In a plan view, these terraces and floodplains together with the channel, normally would form one contiguous unit, with only small inclusions of non-alluvial material such as bedrock outcrops or thin layers of eolian sand or silt. Narrow deposits along stream channels should be mapped upstream within the study area to the point where such deposits no longer may be delineated at the scale of the map base. The total areal extent of these areas should be mapped, along valley margins to the point where the essentially flat-lying stream laid deposits encounter the sloping deposits of the surrounding hillsides.

This procedure should result in the identification of all stream-laid deposits associated with an identified stream channel and exclude isolated higher terraces, separated areally, from the main valley floor. Terrace deposits along upland drainage divides should not be mapped. In the case of alluvial fans, only land fans related to the modern stream course should be identified. It is not intended that the entire surface of large fans found typically in basin and range topography be identified.

F. Regulatory Consultation

The regulatory authority may review the results of this reconnaissance study and identify which areas are clearly not alluvial valley floors, if the applicant desires informal determinations at this stage.

The following criteria can be applied to determinations based on reconnaissance level data:

(1) Areas are clearly not alluvial valley floors if they do not meet the geomorphic characteristics of the statutory and regulatory definitions. Submitted mapping should be field checked to confirming the accuracy of these data.

(2) Lands meeting the geomorphic characteristics but which are not identified as flood irrigated, flood irrigable, or subirrigated can be released from further alluvial valley floor study. These lands must (a) not be presently or ever been in the past flood irrigated, (b) not be flood irrigable, and (c) not show evidence of subirrigation. In order to demonstrate that land is not flood irrigable, there should be no regional precedence for flood irrigation being practiced on valley floor lands of similar physical condition to those of the study area. To be shown not to be subirrigated, the agriculturally useful vegetation community(ies) of valley floor areas must not give evidence of being dependent, either in terms of species or life forms, or excessive moisture which might be supplied by groundwater.

(3) All lands which are probable alluvial valley floors should also generally be wider than 50 feet, and exceed 10 acres in size. A state regulatory agency may develop criteria requesting identification of smaller areas as probable alluvial valley floors, if local agricultural use patterns so dictate.

PART II

Intermediate Study: Investigation of Potential Alluvial Valley Floors Leading to Formal Designation of Alluvial Valley Floors

A. Purpose

Formal designation of alluvial valley floors is based on a regulatory authority determination that an area meets the criteria outlined in regulation (30 CFR 785.19(c)(2)). This part outlines sufficient studies which could permit such a determination to be made.

B. Timing

Since a complete permit application must include the detailed information outlined in 30 CFR 785.19(d) for designated alluvial valley floors, designations should be made prior to permit submittal. It is suggested that the studies described in this part be completed about one year prior to submittal of an application. This timing ensures that the necessary data of 30 CFR 785.19(d) are collected prior to submission of the permit application.

C. Study Area

This has been discussed in Part I (see Part I.C.).

D. Map Scale

Mapping should be completed at the scale of 1:6000 or larger for an area very near the proposed permit area. Mapping of other areas could be completed at the scale of 1:24000 or larger.

E. Specific Study Components

Investigations should focus on documenting the geomorphic and water availability characteristics of any lands within the study area identified in Part I as potential alluvial valley floors.

Surficial geology should be mapped for all potential alluvial valley floors at the more detailed scale appropriate for this part. Mapping should identify all floodplain and various terrace levels underlain by unconsolidated material which are found in the lower parts of topographic valleys. Drill holes and associated lithologic logs, geologic cross-sections, soils surveys and any other geologic data which describes the nature and geomorphic origins of unconsolidated material should be included with this mapping effort. The goal of this effort is to clearly establish the extent of valley floor areas underlain by unconsolidated material. To the degree possible, mapping and accompanying geologic data should indicate valley margin zones where surficial material may overlie valley fill alluvium.

Water availability characteristics can be described under three classes as described below:

(1) "The existence of flood irrigation in the area ... or its historical use" (30 CFR 785.19(c)(2)(ii)(A)) should be indicated for all parts of the study area. Thus, all lands which are or were in the past flood irrigated should be mapped. Any information available concerning the production or history of use of flood irrigation lands should also be submitted. Economic, hydrologic, pedologic, and crop information about irrigated areas might be submitted as well.

(2) "The capability of an area to be flood irrigated, based on stream-flow water yield, soils, water quality, and topography" (30 CFR 785.19(c)(2)(ii)(B)) should be investigated for all flood irrigable lands identified during the Reconnaissance Investigation. The Further Studies herein discussed are designed to substantiate that irrigation is possible on the lands identified as flood irrigated in Part I. In developing water quantity estimates, gaging station data is the best source of information, but is rarely available. Streamflow measurements, limited gaging station records and regional analyses will generally be necessary to establish streamflow characteristics for the stream reach in question. Data generated should provide a basis for estimating the amount of water available for diversion during the times of the year when streamflow is typically diverted in the region. Analyses of quality of waters that may be diverted should be evaluated to establish whether the specific stream's waters are usable for irrigation. Topographic and soils data will be necessary to serve as a basis for estimating transport efficiencies of diversion systems and the suitability of irrigating specific soil types. Based on regional evaluations, (Part I) crops likely to be irrigated should be identified. Given the waters, soils, and crops of the site in question, the overall effect of irrigation on crop yields should be estimated. The focus of these evaluations should be to estabilish (a) if the site conditions are in fact typical of lands customarily irrigated in the region, and (b) if irrigation would be a beneficial land use at the site(s) in question.

"Subirrigation of the lands in question, derived from the groundwater system of the valley floor" (30 CFR 785.19(c)(2)(ii)(C)) should be investigated using soil examination pits, soil descriptions, observations of rooting depth, monitoring of water level and streamflow changes, or other appropriate methods such that the presence or absence of characteristics of subirrigation as defined in 30 CFR 701.5 may be established. Reference should be made to available literature concerning the relationship of rooting depth and subirrigation of crops and range species characteristic of a region. For example, in southeastern Montana Dollkoph (1979) found that alfalfa is entirely dependent on precipitation when groundwater depth exceeds 20 feet. Comparison of observed groundwater levels at a site with this finding could be the basis of demonstrating that subirrigation of alfalfa was not possible. If

alfalfa was the deepest rooting of anticipated crops or range species, then groundwater level data could sufficiently demonstrate the absence of subirrigation at a site.

To the degree possible, artificial subirrigation -- that induced by seepage or constructed ponds, should be distinguished from natural subirrigation.

F. Regulatory Consultation

On the basis of all information submitted consistent with this portion of the guidelines, as well as any other data made available or obtained by the regulatory authority, a determination will be made of the status of lands as alluvial valley floors. To qualify as an alluvial valley floor, lands must meet the geomorphic characteristics described under 30 CFR 785.19(c)(2)(i) and the water availability characteristics of 30 CFR 785.19(c)(2)(ii).

The determination of alluvial valley floor status as it pertains to geomorphic characteristics, relies principally on the identification of alluvial land forms underlain by unconsolidated material. This material is often referred to as valley fill material.

The distinction between alluvium and colluvium is difficult, if not impossible, to make in many western valleys, and many valley fill margins reflect an intertonguing of alluvium and colluvium. Since alluvial valley floors are essentially surface land features, underlain by unconsolidated material, the identification of geomorphic characteristics should therefore be based on landform features, and not necessarily on a distinction between alluvium and colluvium.

In the case of valley floor margins where there is no distinct break-in-slope between hillslope and terrace areas and sloping margins are underlain by unconsolidated material, the designation of the limits of alluvial valley floor lands should be done after review of drilling data. If the surface material is or was successfully flood irrigated, is flood irrigable, or is subirrigated, those margins should be considered alluvial valley floors to the upslope point where drilling data clearly establishes the presence of residual material overlying bedrock.

Although alluvial valley floors are alluvial landforms, review of various Congressional reports, as well as previous mapping efforts, indicates that the entire depositional surface of alluvial fans should not necessarily be designated as an alluvial valley floor (House Report 95-218; Congressional Record, May 20, 1977, pp. S8083 - S8096). Although alluvial fans include unconsolidated debris deposited by streams, the deposits usually do not form valley landforms. Portions of a fan surface may be of various ages and usually do not relate to the existing stream which cuts through the fan. For purposes of alluvial valley floor determination,

floodplains and terraces associated with an existing stream course should be identified as an alluvial valley floor, and these usually do not include the entire fan surface. Similarly, where streams cut across fans in a transverse direction, those areas with terrace landforms related to the existing stream are alluvial valley floors, but the former fan surfaces may not be.

"Water availability sufficient for flood irrigation" can be demonstrated by the existence or successful past use of specific valley floor lands for flood irrigation. Lands flood irrigated in the past may be discounted if irrigation was discontinued because of consistent unavailability of water, insufficient crop yields, or adverse soil or water quality conditions. Water availability can also be demonstrated if (1) there is regional precedent for flood irrigation of such lands (as identified in Part I), and (2) it can be shown that at the specific site in question, that:

(a) it is feasible to construct a diversion at some point on the channel in question which will transport water from the same drainage basin onto the lands in question by gravity flow or water-spreading; and

(b) based on streamflow and other hydrologic analysis, sufficient water is available to irrigate the lands in a manner consistent with the regional pattern of crop production and irrigation; and

(c) based on water quality analysis of waters anticipated to be diverted, and on soils analysis of soils anticipated to be irrigated, that crop yields would be enhanced and soil quality not degraded by long-term irrigation.

"Water availability sufficient for subirrigation" should be established if the submitted data reflect the characteristics of the regulatory definition of "subirrigation". Subirrigation can be disproved if groundwater levels at the site are deeper than the characteristic rooting depth of crops and range species of importance to the region.

Final designation of alluvial valley floors should identify those areas whose width generally exceeds 50 feet in width and 10 acres in size. A state regulatory agency may develop criteria necessitating designation of smaller areas as probable alluvial valley floors, if local agricultural use patterns so dictate.

PART III

Final Investigations: Studies Suggested for Submittal of a Complete Application for a Permit Area Including or Adjacent to an Alluvial Valley Floor

A. Purpose

This part outlines studies which would provide a basis to permit a regulatory authority to make a determination of the factors outlined in 30 CFR 785.19(d)(1) and to make the findings required in 30 CFR 785.19(e). Thus, this part outlines studies which identify the characteristics of an alluvial valley floor, the significance of an affected alluvial valley floor to agriculture, the impact of mining in an alluvial valley floor, the effectiveness of mining and reclamation, and proposed environmental monitoring.

B. Timing

All environmental and projected operational data required of a complete application should be included at the time of application submittal. In some cases, this will necessitate that certain studies be initiated up to one year prior to application submittal.

C. Study Area

For a specific application, the study area for alluvial valley floors includes the proposed permit area and the adjacent area. The permit application thus not only needs to indicate the limits of the proposed permit area, but also the limits of the adjacent area. As discussed in Part I.C., adjacent areas of variable geographic extent may be identified for each, environmental resource to be affected by proposed mining and reclamation operations.

A permit application includes detailed justifications of the limits of adjacent areas, including the surface water adjacent area and the ground water adjacent area. Of principal interest in identification of a groundwater adjacent area would be the area where assessible drawdown and water quality changes from mining and reclamation operations would occur. Of principle interest in identification of a surface water adjacent area is the area receiving runoff from mining and reclamation operations. For purposes of alluvial valley floor studies, alluvial valley floors identified on the basis of flood irrigation characteristics should be studied within the surface water adjacent area and permit area and alluvial valley floors identified on the basis of subirrigation characteristics should be studied within the ground water adjacent area and permit area.

D. Map Scales

As required in 30 CFR 771.23(e)(1), all maps of the permit area should be at a scale of 1:6000 or larger. Maps of alluvial valley floors should be at a similar scale. However, more general or summary maps can be submitted at a scale of 1:24000 or larger.

E. Specific Study Components

The studies herein suggested are consistent with those required in 30 CFR 785.19(d)(2) and (3). Review should be made of these subparts since they suggest the manner of data presentation and summarize the studies which should be undertaken. Reference should also be made to Table 1 of this Guideline which lists each study described in this part and its applicability to studies of either flood irrigation or subirrigation alluvial valley floors as well as to the various relationships between alluvial valley floors and mining areas. Generally, alluvial valley floors within the affected area require more study than alluvial valley floors elsewhere in the permit area or in the adjacent area because mining in the affected area implies direct disturbance of the alluvial valley floor, and thus implies reclamation and restoration of an alluvial valley floor. Alluvial valley floors possessing only flood irrigation characteristics do not require the detailed subsurface investigations required of subirrigated alluvial valley floors.

1. Geologic Data (30 CFR 785.19(d)(2)(i)

Geologic studies of alluvial valley floors should be integrated with geologic studies for the permit area required in 30 CFR 779.14, 779.25, 783.14, and 783.25. Data which might be included in a permit application could include:

(a) Geologic, geologic structure, and surficial geologic maps for the study area. Data for these maps should be based on field mapping, drill hole data, and other geologic data. The geologic map should show each distinguishable and mappable lithologic unit, fault, and prominent fracture zone. The geologic structure map should show structure contours on each coal bed proposed for mining. The surficial geologic map should distinguish, for example, between floodplain alluvium, terrace alluvium, alluvial fan deposits, lake and pond sediments, landslide deposits, slopewash and residual deposits.

(b) Detailed geologic cross-sections of alluvial valley floors within the study area, based on detailed lithologic logs, showing significant changes in subsurface lithology within the alluvial fill as well as in underlying bedrock units. Valley cross-sections should be developed along all well transects both perpendicular and longitudinally along valley axes. Transect cross-sections should extend horizontally into surrounding bedrock areas and to a depth that ensures all bedrock units proposed for mining are shown.

(c) Detailed chemical and physical analyses characterizing all overburden material scheduled to be disturbed within the permit area. These data should be correlated to the geologic maps and cross-sections and lithologic logs.

(d) Field surveys of the longitudinal profile of the thalweg, floodplain, and at least one terrace surface of the alluvial valley floor, for the entire length of valley within the proposed permit area and for representative portions of the thalweg for all valley floors in other portions of the permit area and adjacent areas. For each longitudinal survey, indicate depth of bedrock along the profile, and variations in depth.

For alluvial valley floors within the affected area, survey ground surface elevation at several cross-sections across terrace surfaces, to upland slopes on each side of the valley, and determine depth to bedrock along the cross-section. Cross-sections should be located to give the maximum geologic (and hydrologic) information and should include areas near observation well transects. Representative bed and bank material samples should be collected at each cross-section site, and mechanically analyzed.

Cross-sections should be located so that they can be resurveyed in the future. Cross-section and longitudinal profile data should be reported at scales sufficient to show physiographic details of the valley.

Based on geomorphic, geologic, soils, and other relevant information, a description of the recent geomorphic history of the valley floor in question should be prepared. Particular attention should be paid to erosional or depositional trends identified in the valley system.

2. Soils and Vegetation Data (30 CFR 785.19(d)(2)(ii))

Soils and vegetation studies of alluvial valley floors should be integrated with similar studies for the permit area required in 30 CFR 779.19, 779.21, 783.19, and 783.21. Data which might be included in a permit application could include:

(a) Soil survey and appropriate descriptions of soil types. This information is necessary for the permit area to plan for revegetation. For alluvial valley floors located in adjacent areas, soils information beyond that outlined in Part II need be collected. Soils data should be sufficient to understand the characteristics of soils which make it irrigable or which permit subirrigation.

(b) Vegetation map and appropriate descriptions. A vegetation map of areas designated as alluvial valley floors showing vegetation types and plant communities, should be submitted. A narrative description should be provided of each vegetation type, describing and defining it so that similar mapping could be repeated by an independent worker. The narrative description should also list all species found in the vegetation type and rank each species in the vegetation type as to relative dominance.

Quantitative data should be collected for each vegetative type and terrace level separately. Sampling programs must be adequate and sample design sound. Specific items to be measured in a statistically accurate manner are: (1) percent canopy cover by species, (2) percent litter, and (3) percent bare ground. Annual above ground production should be measured by species. Care should be taken in controlling the effects of grazing by large animals prior to measurement. Generally, measured areas should be excluded from grazing for at least the growing season during which measurements are taken. Rooting depths for predominant trees, shrubs and grasses on each terrace level for each vegetative type should be estimated, if possible. The actual and potential animal unit months per acre should be calculated for each vegetative type and the condition class and trend should be evaluated. Possible reasons for trends should be given.

3. Surface Water Data (30 CFR 785.19(d)(iii)

Surface water studies of alluvial valley floors should be integrated with similar studies for the permit area and adjacent area required in 30 CFR 779.16 and 783.16. Data which might be included in a permit application includes:

(a) At least one continuous discharge measurement site in the channel of each alluvial valley floor with an intermittent or perennial stream in the study area. Other gaging station sites should be established if necessary to further detail the hydrologic system. Streamflow records should be submitted and refined as statistically sound stage-discharge relationships are developed. In some cases, data from adjacent stream reaches where gaging stations already exist may be substituted for data herein suggested streamflow on ephemeral stream should be monitored in such a way that annual runoff and peak flow can be evaluated. If such station exist, flood frequency and low flow analyses should be completed for the available records.

(b) Flood flow estimates for all alluvial valley floors in the study area. The area inundated by selected recurrence floods (up to 100 years) should be identified.

Estimates of mean annual and monthly stream flow should be made for streams within alluvial valley floors.

(c) Estimates of the runoff contribution and sediment yield from the proposed permit area to any alluvial valley floor. Estimates should be made for runoff and sediment yield from hillslopes and flow and sediment transport in channels tributary to alluvial valley floors.

(d) The water quality characteristics of alluvial valley floor stream flow should be described such that high and low flow, as well as seasonal variations, are evaluated.